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See Culling & Smith

with the Sutherland Course

[P.]

ON THE
ARROW-ROOT OF BERMUDA.

BY CHARLES COGSWELL, M.D.

Extracted from the Monthly Journal of Medical Science,—October 1845.

IN consequence of a certain want of clearness in works of reference, concerning the identity and structure of that part of the *Maranta Arundinacea* which yields the fecula called Arrow-root, I took the opportunity, while on a visit to Bermuda, from the latter part of February last, till the 20th of June, of paying some attention to this subject. The term of my stay commenced towards the close of the arrow-root harvest, and from thence included only the early period of the growth of the new crop. I cannot, therefore, attempt to give a thorough systematic account of the plant from personal investigation; but it is hoped, under correction of the high authorities in question, that the observations about to be communicated respecting some points in its natural history, apparently not well understood, together with other incidental details, may be useful to the medical public.

The Bermudas, or Somers Islands, lying in latitude $32^{\circ} 19' 1''$ N., and therefore near the boundary between the temperate and torrid zones, partake, as might be expected, of the peculiarities of both divisions, in the forms of their vegetation. Here, when I landed at St George's, were growing in the garden of the hotel, pease, carrots, potatoes, both Nova Scotian and sweet, lettuce,

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onions, and strawberries, under the shadow of oranges and lemons, roses in full bloom, the Bermudian cedar, the cotton, peach, pomegranate, the uncouth papaw, and the graceful banana (*Musa Sapientum*.) The tendency of the climate inclines, however, rather towards the equator than the pole; for although most of the common kitchen vegetables thrive luxuriantly under cultivation, one looks in vain for the apple and pear, the plum and cherry, which compose the staple of an English orchard. Patches, not to be called fields, of arrow-root, were visible along the road throughout the islands, and before many of the doors lay dozens of long wooden trays, exposing their white contents to the sun. The first exploring expedition, with reference to the object of this paper, was made in company with a friend, to a spot where we saw a negro leisurely employed in turning up a reddish-brown soil, scattered over with withered leaves. Here and there some more vigorous, or longer-lived specimen, contrived to sustain its head erect amid the surrounding decay. The man appeared somewhat perplexed with the meaning of inquiries founded on our pre-conceived ideas. To his apprehension the whole affair was perfectly simple. He had but to dig up a jointed root, shaped much like a carrot, break off a piece towards the smaller end, and cover it up again with earth,¹ to secure a new crop for next season, while the upper and thicker portions were thrown into heaps, preparatory to being carried to an adjoining mill, and converted into arrow-root. As for the *Tous-les-mois*, lately introduced, he seemed to regard it as an intruder, and pulled up a root, resembling three onions, "fused" together, which he put into our hands with an air of contempt. We had afterwards reason to think that his sentiments on this subject were not shared by the better informed of the population.

According to Dr Christison, "the *Maranta Arundinacea*, now cultivated generally throughout the West Indies, was first transplanted into the English settlements from Dominica, about the middle of last century.² It belongs to the Linnæan class and order *Monandria Monogynia*, and the natural family *Drimyrrhizææ* of Decandolle, and *Marantaceæ* of Lindley. It is a herbaceous plant, about three or four feet high." As respects all that appears above the soil, I have no remark to make, with this exception, that although an elevation of four feet is by no means without example, the growth which does not exceed an average of two feet is held in

¹ Our informant was more indifferent than usual, to the agricultural rules of manuring and rotation.

² Mr Waterton found the plant growing spontaneously in Demerara. "This (to quote his own words) appears to be the native country of the arrow-root. Wherever you passed through a patch of wood in a low situation, there you found it growing luxuriantly."—*Wanderings in South America*.

most esteem in Bermuda. Touching the root and its manufacture, every information in their power was afforded by intelligent persons engaged in the cultivation; upon whose explanation of specimens picked out of heaps upon the ground, and the examination of some that were sent to my place of abode, the following description is founded.

Figure 1 is a drawing made from nature, of one of the simplest forms which the plant presented. *a*, the herbaceous stem, *b, b, b*, the jointed root, *c, c, c*, root-lets.

We shall suppose a piece, comprising several of the lowermost joints, to have been broken off and deposited in the soil. From the side of one or more of the joints proceeds a shoot, which extends itself by the development of new joints, and throws out leaves which ascend to the height of two, three, or four feet. After the lapse of a stated time, that is, eight or nine months, the plant has arrived at maturity; the leaf withers, and the root prepares to propagate a new growth. It is now capable of *yielding the fecula*. But if allowed to remain much longer in the ground than is requisite for its own perfection, the simple form ceases to exist, in consequence of the addition of a young progeny of future plants, in the form of *tubers* also *yielding fecula*; and a degree of complexity prevails, which affords equal support to both parties who argue in favour of one or the other as the source of arrow-root. That the

question is one of some mystery, is evident, from the conflicting opinions even of persons practically conversant with the subject. The difficulty may in part arise from the circumstance of the seasons of harvest and planting being in fact so blended with each other, that no sooner is the vegetable prepared to multiply its kind, than it can proceed without interruption, so far as the climate is concerned. Such as above stated, at least, is the conviction impressed upon my mind, both from hearing and observation; and which is now to be submitted, whether for confirmation or disproof, to those who may have still greater practical opportunities of arriving at the truth. See Figure 1, where *e* is a young shoot coming out from the *rootstock* at an angle, and *f, f*, are buds like the *eyes* of a potatoe in an incipient state of development.

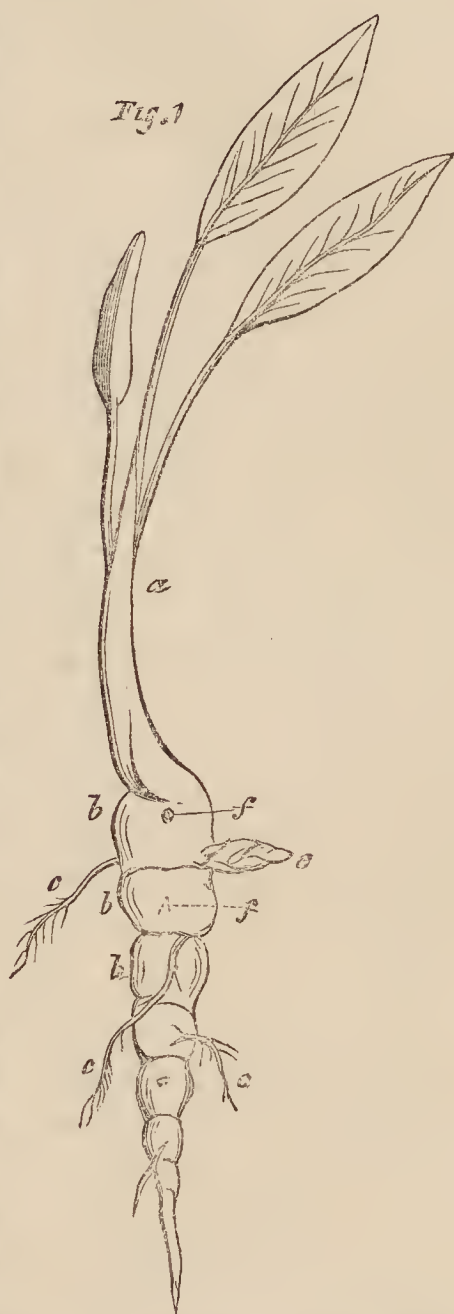


Figure 2 is a drawing made from another specimen, which affords a more perfect illustration of the supervening process of vegetation. *a*, the withered stem, *b, b, b*, new plants growing from between the joints of the rootstock, *c, c, c*, rootlets. It may be here observed, that the *rootlets* are not known, as supposed, to *swell out into tubers*; *d*, the shrunken remains of the setting of the previous season. A difference will be perceived between the exteriors of the rootstocks in the two figures. This is occasioned by the covering of "large, thin, pointed scales" (Christison) being allowed to remain in figure 2; they were so thin and closely adherent, as to partially permit the lines of junction of the root to appear from underneath; but in figure 1 they have been stripped off, in order to afford a distinct view of the subjacent structure.



The parts that yield the fecula, viewed externally, present a cream-white glistening surface, produced by the close aggregation of longitudinal fibres. On snapping one asunder, which is easily effected at the joints by the strength of the fingers, the fracture exhibits an intermixture of moist white fecula with the extremities of delicate fibres which slightly protrude. The process of separating the fecula is one that demands rather the exercise of skill and precaution, than the application of a great amount of mechanical force. In describing the various steps of the manufacture, to which we shall now proceed, I cannot perhaps do better than follow in the track of the sable guide to whom our first inquiries were directed; not, however, so closely as to refrain from generalization.

The *first* object is to get rid of the thin paper-like scales above noticed. This is done either by the hand, or by means of friction in a hollow cylinder, composed of wooden bars attached to the circumference of circular boards, and made to revolve on its axis; in fact, not unlike a machine I have seen used for cleaning shot. *Secondly*, Passing into the interior of the mill, (a wooden shed divided by a partition,) we beheld two men busily employed in working an apparatus, almost identical in its construc-

tion with the common grindstone and trough. The wheel, which was framed of wood, was faced round the circumference with tinned iron, punched into numerous projecting holes, like a nutmeg-grater. Sometimes a fly-wheel is added. A third operator was moving to and fro, with the right hand, the upper end of a piece of board of the same breadth as the wheel, and so adapted to it at the lower extremity by a hinge construction, as to allow of his alternately introducing fresh supplies of the crude material, with the left hand, between the wheel and the board, and exerting a sufficient degree of pressure with the other, to cause it to be crushed and drawn down into the water trough. The whole substance was thus converted into a confused pulpy mass of fecula and fibrous matter. *Thirdly*, This was taken to the adjoining room, and put into a cylindrical sieve, fixed horizontally on its axis over a large tub of water, in which the lower half of it was immersed; to an axle passing through the cylinder were attached strong iron wires, bent like those of a wool-card, which, being turned by a handle, had the effect of washing out the fecula, and causing it to escape through the meshes to the bottom of the tub. *Fourthly*, The fecula was then successively washed over tubs through common sieves of gradually diminishing interstices, and when thought sufficiently pure, was allowed to settle until it coalesced into a solid mass. The use of water was now at an end. On being poured off, it left a brownish surface, which disappeared on being wiped, and the arrow-root was presented in the state of a white, firm, elastic cake. *Fifthly*, This is broken into little pieces, and exposed to the sun, if the wind be from the north; if southerly, when it is damp and unfavourable, the previous operation of a wooden press is preferred. When sufficiently free from moisture, it is spread upon sieves with large wooden meshes, and exposed to the sun over trays into which it drops as the remainder of the water evaporates.

The chief precautions required in these operations are, to prevent the fecula from remaining too long in water, when it is apt to turn sour; and to employ that fluid in a state of the utmost attainable purity. The larger proportion of the water used in Bermuda is what comes from the clouds; passing through a pure atmosphere, it is received upon the roofs of houses, or sloping platforms upon the ground, all kept scrupulously white and clean, and thence flows into capacious tanks. There must be no stint likewise of the quantity employed. About ten half hogsheads (which are the vessels commonly used as tubs) are necessary for three of arrow-root in the raw state. It is said that brackish spring water has once or twice been negligently employed; the curious effect of which was, that although no difference was perceptible at first, the article was found to assume a leaden tinge after reaching the London warehouse.

It will be remarked, in the perusal of these details, to how great

an extent manual labour is brought into exercise. Time was, indeed not many years ago, when nearly the whole duty was performed by the hands, and the article used to fetch a dollar the pound. At present, however, although there are domestic manufactories still more primitive than the one referred to, there is a large establishment near the capital belonging to Mr H. J. Tucker, which is worked by horses, and produces the largest quantity made by any individual.

The Bermudian arrow-root has the reputation of being the finest brought to the British market. The causes of this superiority may be various. As far as could be ascertained, they appeared to reside partly in the purity and lavish expenditure of the water employed; partly in the honest intentions of the people, perhaps promoted by the scarcity of materials suitable for adulteration. Thus wheat and potato starch are neither of them ready at hand; the grain not being grown in Bermuda, and potatoes¹ fit for the table, bearing an average price of four shillings per bushel. To test the purity of the article when suspicious, the inhabitants apply the process of diffusion in water; genuine arrow-root subsides to the bottom in a few moments, but the presence of an inferior starch is denoted by protracted turbidity. For determining the presence of the *Tous-les-mois*, however, if that question should come to be raised, this method is not likely to answer, and the microscope may be resorted to, as recommended by Dr Christison, in order to distinguish the relative sizes of the globules. The plant called *Tous-les-mois*, “a species of canna,” mentioned in the early part of the paper, is now cultivated to a small extent in Bermuda; some of the residents believe that the fecula prepared from it yields a stiffer and more permanent jelly than arrow-root; and, as the climate is exceedingly favourable, there appears no improbability that it may in time rival, if not supersede, the latter altogether.

The quantity of arrow-root manufactured this year in Bermuda may be estimated at about 400,000 pounds weight. Of this total, rather more than three-fourths have come to England. It is hoped there can be no impropriety in mentioning here, for the sake of those who may be concerned to know on uninterested authority where to apply, that the chief direct agents for Bermuda in London are B. C. T. Gray, No. 31 Great St Helens, and Johnson & Co., No. 5 Barge Yard; the supplies furnished by these gentlemen can be relied upon as confidently as if purchased in Bermuda. Arrow-root, in regard to *quality*, has been referred by writers to three classes, and stated to be put up in corresponding packages: the

¹ The common potato is imported largely for consumption, and entirely for seed, from Nova Scotia and Prince Edward's Island, where it arrives at great perfection. Of late, more attention has been given to its cultivation in Bermuda; and so satisfactory are the results, as to encourage a reasonable hope of being able to gratify the London epicures with abundance of new potatoes in the month of April.

first in tin cases, the next in wooden boxes, and the third in barrels. In Bermuda, however, there is no such classification attended to; the very best may be put into barrels and the worst into boxes, according to the will of the individual who contributes his quota to the general stock in the market. To understand this, it must be borne in mind, that there is no recognised distinction in the quality of the root itself that should necessarily affect the value of the article produced from it; nor does there appear to exist that complexity in its organization, which in the instance of the cereal grains, is another obstacle to uniformity. Any difference of quality observable is occasioned by the greater or less skill of the respective manufacturers, none of whom, it may be supposed, would voluntarily stamp the results of their own best efforts with a conspicuous avowal of inferiority. And, after all, in circumstances where the whole product is essentially alike for useful purposes, the chief source of preference being merely fanciful, relating to the entire absence of colour, it requires no stretch of charity to imagine that the parties themselves may be often unconscious of any defect. Tin cases are rarely used. The boxes are made of white pine, and the barrels (to contain about 100 pounds each) are of white American oak, neither of which woods is apt to communicate stain or odour; for further protection, a lining of blue paper is interposed. This year, for the first time, Mr Gray has received a quantity put up, like starch, in 6 lb. *paper* parcels, which he considers to be the finest he ever saw.

We have hitherto delayed noticing what becomes of the refuse fibrous matter which remains in the early stages of the preparation of the arrow-root. This has been used as food for cattle, which purpose it is said to answer tolerably well. Of late, an attempt has been made to ascertain whether it may not be advantageously turned to account for making paper; to this end, a quantity was made into a kind of cloth, not unlike a coarse felt in appearance, and transmitted to England; but I learn that the sample prepared has not proved sufficient to permit a fair trial to be made, and that the intention is to await the arrival of an adequate supply.

Whether arrow-root shall ever thrive in England as an article of rural economy, is perhaps hardly a question that deserves serious consideration, when we regard the warm temperature which it requires. But there appears no good reason why it should not succeed in an artificially qualified atmosphere, for the gratification of the curious and scientific. On embarking in the steamer *Medway*, on the 20th of June, I took on board a box containing several growing specimens of arrow-root and *tous-les-mois*. The latter plant much resembles arrow-root in its general style, but has a larger and more succulent leaf. A warm and sheltered situation having been

allotted to them behind the funnel, they appeared at first to thrive tolerably; but, towards the termination of the voyage, which lasted thirteen days, the leaves were all withered at the edges, and some of them lay entirely dead, owing to unavoidable draughts, and changes of temperature. By the time of their reaching a hothouse near London, three weeks from leaving Bermuda, almost the only visible tokens of the arrow-root above ground were a few decayed leaves, but the stems at least of the others were still erect and green. There is little danger apprehended, therefore, as to the fate of the *tous-les-mois*; and even the arrow-root is thought likely, on examination, to spring up and flourish anew.

As it is possible that no attempt has before been made to raise these plants in Great Britain, I would suggest, for the benefit of any future projector of sufficient botanical zeal, the propriety of importing the roots in their fresh state, as dug from the soil in the months of December, January, and February. The constant and rapid communication by steamers renders this course more practicable now than formerly. The roots may be packed in the manner prescribed by authorities on such subjects, but with care to have them secured, both on board and after coming on shore, from the influence of the cold weather; and as soon as possible they should be established in a hot-house.

LONDON, August 1, 1845.